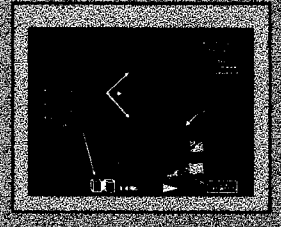
Technology Validation Needs for Earth Science

Earth Science Implementation Plan

Baseline Measurement Studies

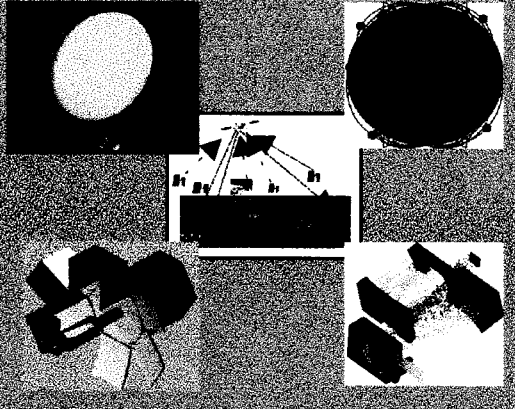


Earth Science Vision

Technology Needs

Flight Validation Rationale

Earth Science Technology Validation Needs



Technology Pipeline

- Advanced Technology Initiative
- Instrument Incubator
- Cross Enterprise Technology
- Other Agencies
- Industry

Emerging Technology

Program Attributes

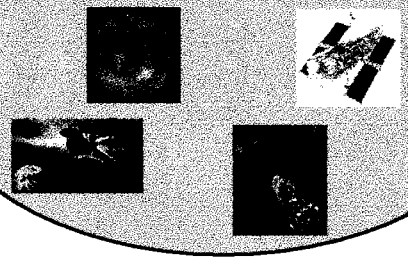
Technology - Focused Projects

Phase A Phase B

Technology - Focused Project Formulation Process

- Ensures focus on technology needs of future science missions

Multi-Mission Technology Benefits



- Broad user community

Breakthrough Technologies Requiring Flight Validation

Phase A

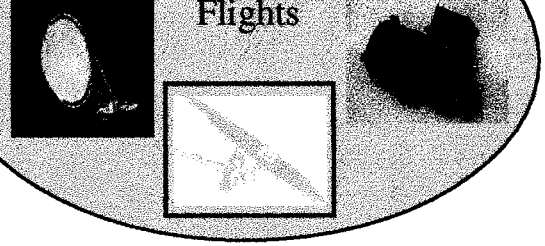
- Open competitive technology calls
- Strong rationale for flight validation

New Millennium Program

Partnership / Shared Launches

- Increases launch opportunity
- Reduces "low tech" elements' costs

System/Subsystem Approaches with Frequent Flights

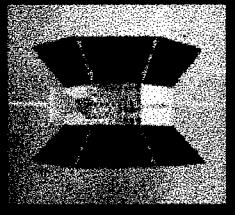


- Maximizes cost effectiveness of validation approach
- Balanced portfolio
- Flexible / adaptive / resilient

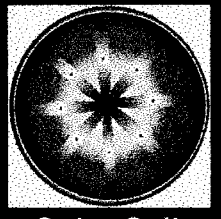
Challenges to New Millennium Program

- Improve cost-effectiveness of technology flight validation
  - Focus NMP investments on breakthrough technologies/risk reduction
    - ◊ Increased reliance on flights-of-opportunities
    - ◊ Focus on technology "pieces" requiring flight validation
- Deliver benefits to broad set of Earth and Space Science measurements
  - Reduce cost/enable new capabilities
  - Align technology with science needs
- Enhance partnership for technology development/validation and accelerate technology infusion

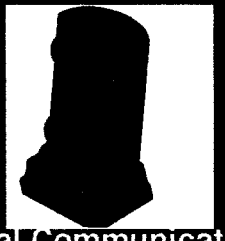
Potential Technology Flight Validation Needs



Microspacecraft

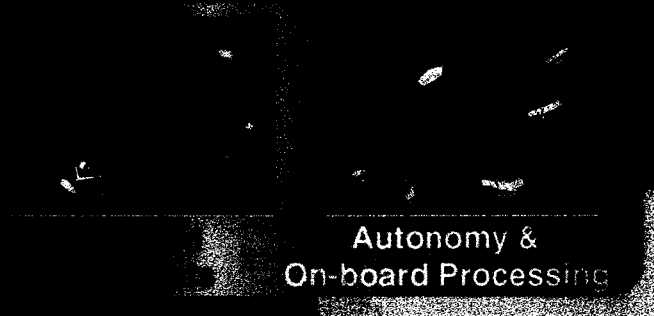


Solar Sail



Optical Communication

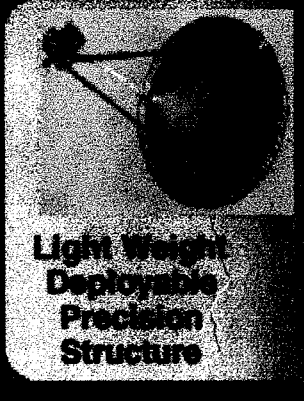
Robotic Assembly



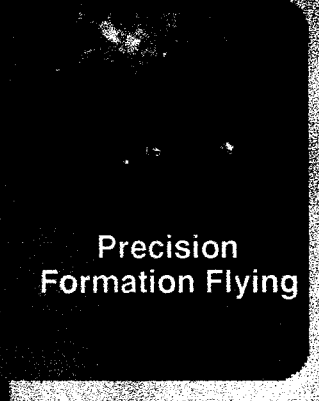
Autonomy & On-board Processing

Tethers

Drag Free Inertial Sensors



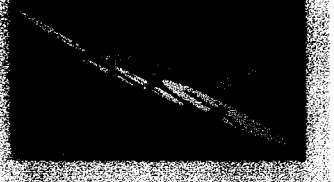
Light Weight Deployable Precision Structure



Precision Formation Flying

Gossamer Optics

Thermal Control Precision Metrology



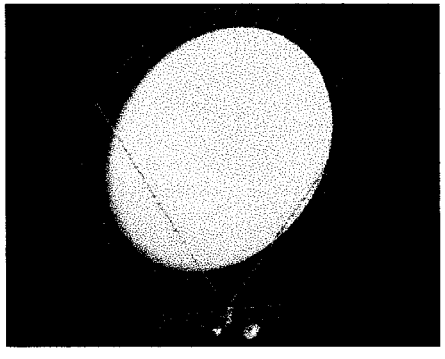
Structure & Evolution of The Universe

Astronomical Search for Origins

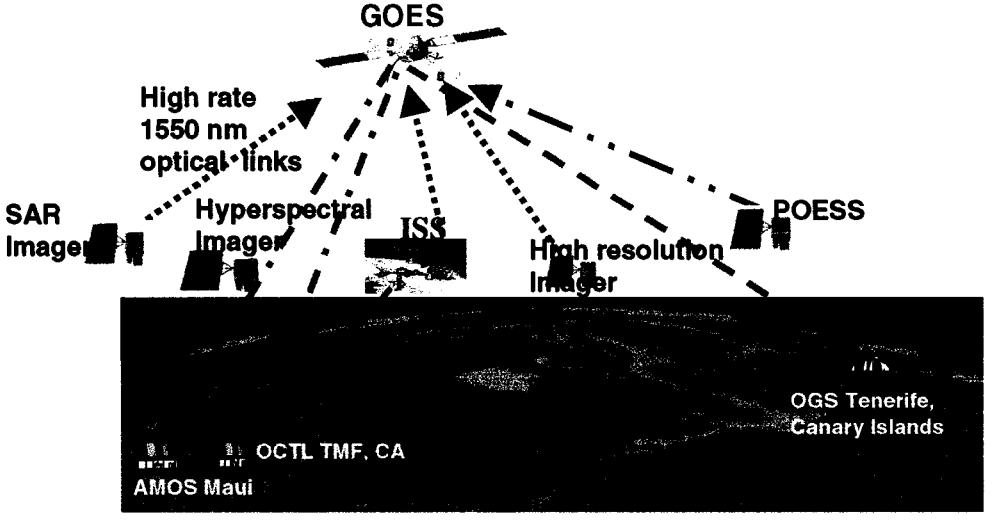
Technology Subsystem Themes

- Preliminary assessment of technology validation needs
- Recurring technology subsystem validation "themes"
- Technology themes benefit a broad set of Earth Science measurements.

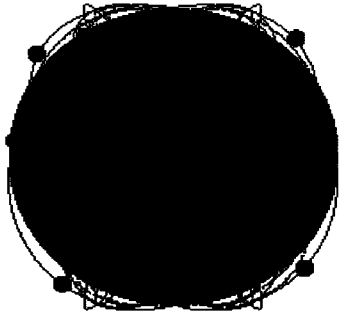
Inflatable Microwave/ Milliwave Antennas



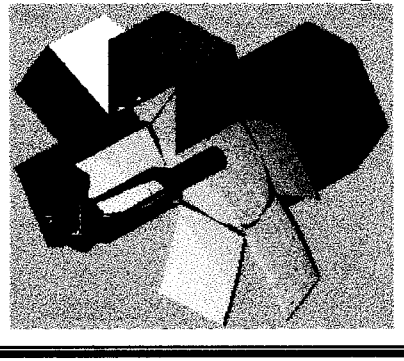
Ultra High Data Rate Communications



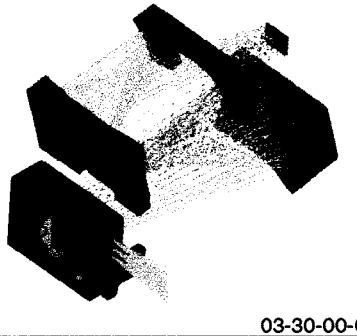
Intelligent Distributed Spacecraft Infrastructure



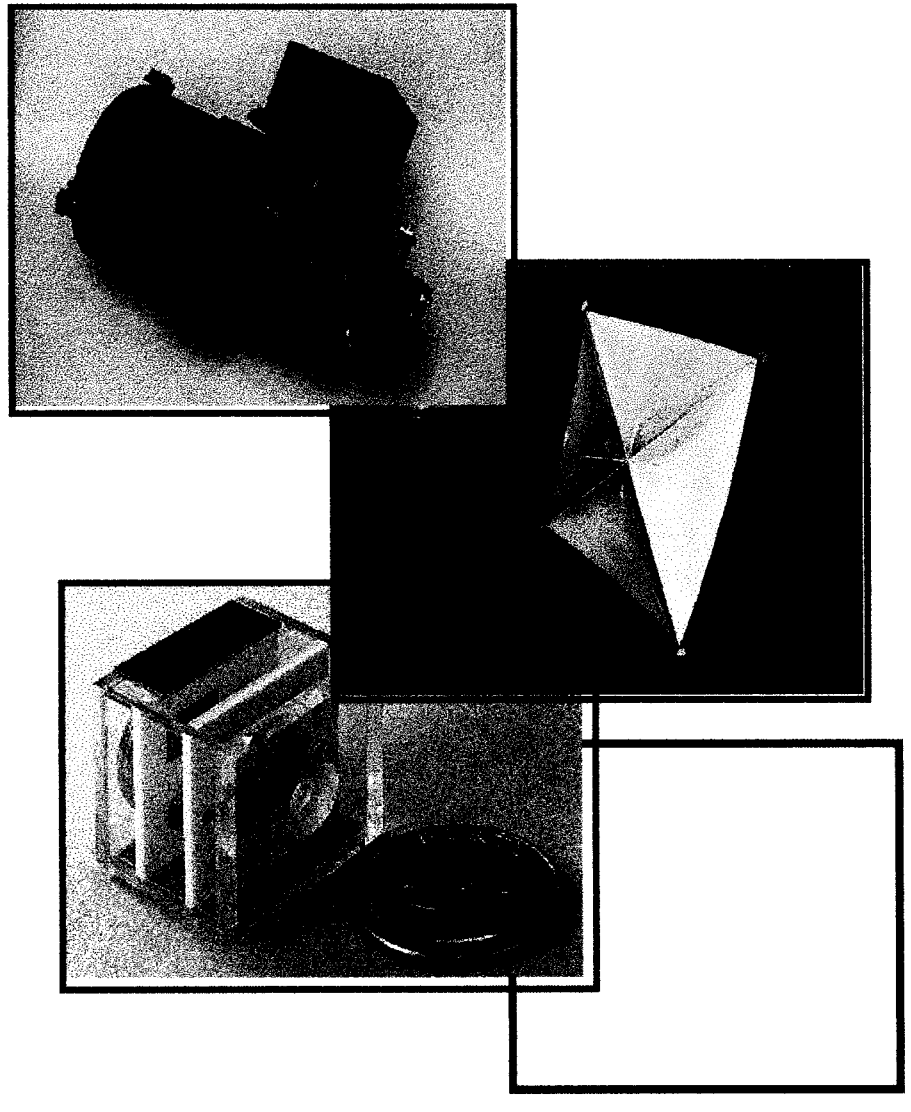
Light Weight Deployable UV/Visible/IR Telescope



High Performance Spectrometry

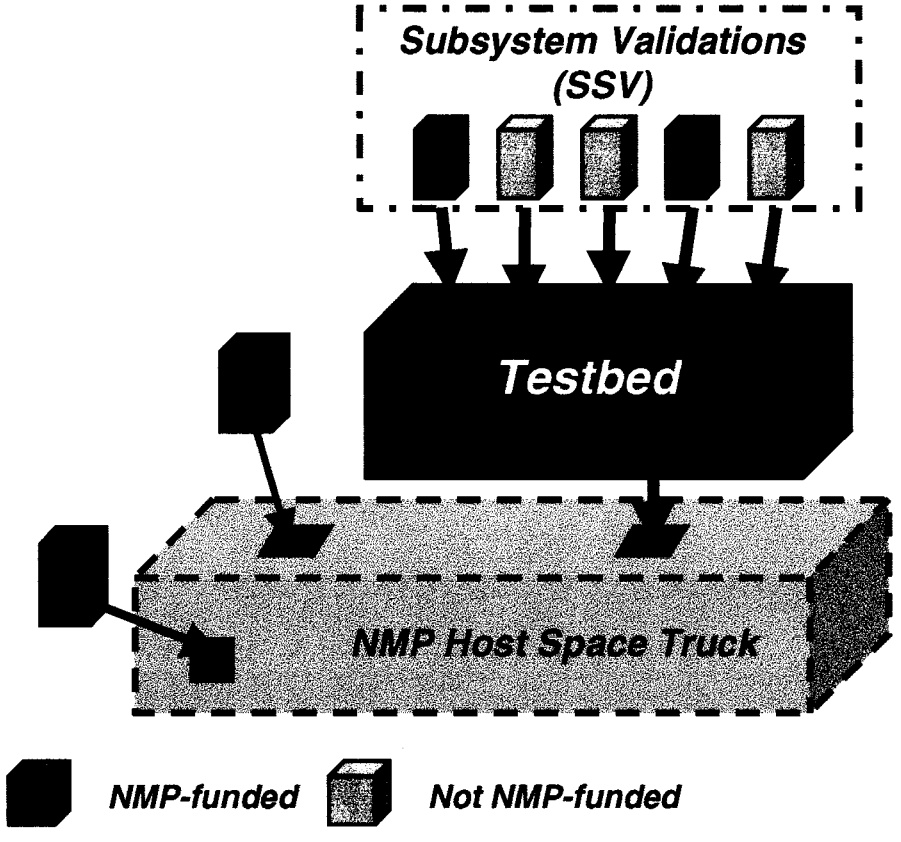


Sub-System Technology Validation



- Yearly flight opportunities for several sub-systems as stand-alone units on flights-of-opportunities or in a testbed (Space Truck)
  - NASA hosts one testbed flight every 3 years
  - Flights of opportunity (FOO)
  - Other NASA missions, Shuttle, DoD & commercial flights

Testbeds for Sub-system Technology Validations



- Definition: Common support hardware & software to validate several subsystems or components
  - Facilitates harvesting subsystems & components developed in & outside space science
  - Outside space science = Industry, other NASA technology development programs, other government agencies

Geostationary Imaging FTS (GIFTS)

Objectives:

Primary: **Greatly Improve Weather Forecasts By Measuring the Horizontal and Vertical Flux of Water Vapor**
Observe Temperature, Water Vapor, and Tracer "Wind" Profiles with High Vertical, Horizontal, and Temporal Resolution

Secondary: **Demonstrate Utility of Geostationary Satellites for Atmospheric Chemistry Studies**
Observe Vertical Profiles and Transport of Radiatively Active Trace Gases including H_2O, CO, O_3, CH_4

Technology Basis: **Combine Two Measurement Technologies**
Large area format Focal Plane Array (LFPA)
Fourier Transform Spectrometer (FTS)

Measurement Capabilities: **Imaging, Sounding, and Chemistry**

Full Disk Imagery: IR (4 Km) /VIS (1 Km) Imaging with 5 minute temporal frequency

Full Disk Sounding: Hourly, Low Spatial Resolution Temperature, Moisture, and Winds for Global Forecasting

Regional Sounding: (6000 x 6000 Km), Half Hourly, High Spatial Resolution Temperature, Moisture, and Wind Soundings for regional weather forecasting

Mesoscale Sounding: (3000 x 3000 Km), Hourly, Ultra-high Vertical Resolution Soundings for chemistry, hazardous weather prediction applications, and self-validation of regional and full disk products